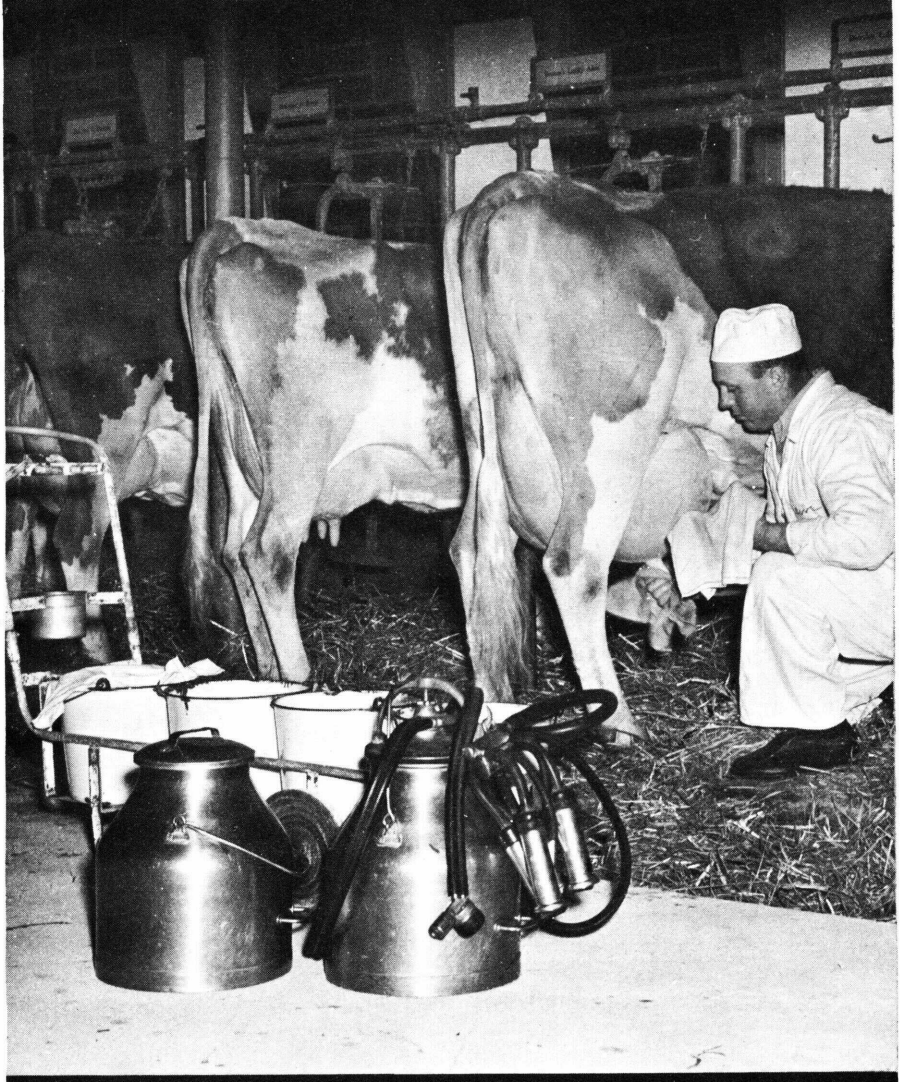
CLEAN MILK PRODUCTION



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CLEAN MILK PRODUCTION

By FRED M. GRANT, *dairy husbandman, Animal Husbandry Research Division, Agricultural Research Service*[1]

Contents

	Page		Page
What is clean milk?	1	Methods	11
Importance of producing clean and wholesome milk	1	Clean cows	11
The producer's interest	1	Clean barns	12
The consumer's interest	2	Clean utensils	13
Bacteria in milk	2	Milking and handling milk	17
Equipment	3	Control of flies	21
Healthy cows	3	Keep feed and weed flavors out of the milk	22
Barns	5	Summary	23
Utensils	7		
Milk room or milk house	8		

WHAT IS CLEAN MILK?

STRICTLY SPEAKING, the term "clean milk" excludes milk that contains any foreign matter or bacteria whatever. However, for practical purposes, "clean milk" is defined here as milk that comes from healthy cows, is of good flavor, is free from dirt, and contains a relatively small number of bacteria, none of which are harmful to human health.

IMPORTANCE OF PRODUCING CLEAN AND WHOLESOME MILK

THE PRODUCER'S INTEREST

Every year the dairy farmers of the United States suffer heavy financial losses because too large a proportion of the milk and cream they market is lower in quality than it should be. It is estimated conservatively that they could add many millions of dollars annually to their income simply by giving attention to those factors that promote high quality of product. Sour and off-flavored milk and cream are not readily marketable; and when the dairyman does find a market, the price he gets is usually low, as compared with what he might get for a product of high quality. Furthermore, high-quality products cannot be made from low-quality milk, so the losses from low-grade milk and cream extend to all products. On the other hand, milk and

[1] This bulletin is a revision of and supersedes Farmers' Bulletin 602, Production of Clean Milk, by Ernest Kelly and C. J. Babcock. In preparing this revision, the author has used freely the information in the previous publication.

milk products of high quality not only bring better prices but also tend to increase consumption and thereby extend the dairymen's market.

In the flush season of milk production dealers have the opportunity to select their supplies on a quality basis. When the flush occurs, those producers who offer low-quality milk are the ones who are eliminated from the best market. Low-quality milk is what the buyer rejects first. High-quality milk retains the market.

On the farm, the milkers and all people who handle milk should realize that they have in their charge a food that is contaminated easily. Safeguarding the wholesomeness of the milk supply on the farm protects the health of the farm family, who use a part of the milk, and also protects the health of the calves, which live largely on milk.

Healthy cows to breed from, and pure milk to feed, are two important factors in rearing thrifty calves and in the development and maintenance of a healthy and profitable herd.

High-quality products are the basis of prosperity for the dairy industry. Irrespective of the requirements of any outside supervising agency, each milk producer must realize his responsibility for selling clean milk and cream. Failure to do this will seriously impair the welfare of the individual and of the industry.

THE CONSUMER'S INTEREST

Milk is necessary for the growing child; and the adult has learned that milk is one of the most valuable foods, because it is nourishing, economical, and easily digested. The consumer, however, will accept milk as a food only when he has confidence in its wholesomeness. Serious epidemics of typhoid fever, septic sore throat, and other diseases have been spread through milk that was not produced carefully or pasteurized properly. Evidence indicates that tuberculosis may be transmitted from animals to human beings, chiefly young children, by the consumption of raw milk containing tubercle bacilli. (Raw milk is milk that has not been pasteurized.) Health is endangered not only by milk that contains specific disease-producing bacteria but also by milk that contains large numbers of certain other kinds of bacteria that may cause serious digestive disturbances, especially in infants and invalids. Another consideration is the loss to the consumer from milk souring or otherwise spoiling before it can be used. The cleaner the milk the longer it can be kept in a sweet, wholesome condition.

BACTERIA IN MILK

Bacteria are single-celled plants that are so small they cannot be seen with the naked eye.

All milk, unless it is produced under very exceptional circumstances, contains some bacteria.

Milk is an ideal medium for bacterial growth. Bacteria, at maturity, divide to form two bacteria, and under favorable conditions the two new individuals may become full-grown and repeat the process of division in from 20 to 30 minutes. The bacteria commonly found in milk multiply most rapidly at temperatures between 80° and 100° F. At 70° the rate at which the bacteria multiply is slower. At 50° the rate is still slower. At 40° and below the rate is very slow. However, a few types of bacteria continue to multiply even at the freezing point.

Many bacteria ordinarily found in milk cause no apparent change in the milk. Others may change the flavor without changing the appearance. Some of the most common types of bacteria cause marked changes in both appearance and flavor. Among the latter are the bacteria that sour milk by converting the milk sugar into lactic acid, and those that cause the formation of a sweet curd. Another type of bacteria decomposes the casein and albumin in the milk and causes putrefaction and undesirable odors.

The number of bacteria in milk depends on the number of bacteria in the udder of the cow, on the amount of contamination from outside sources, and on the rapidity or the rate at which the bacteria increase in number.

It is very important to bear in mind that the rate at which bacteria grow and increase in number depends very largely on the temperature at which the milk is kept.

EQUIPMENT

On farm score cards, equipment is given a score of 40 points and methods 60 points out of the total of 100. This emphasizes the relative importance of equipment as compared with that of methods. It does not indicate, however, the importance of good equipment as a means of easing the labor problem, and thereby simplifying and encouraging good methods of production.

HEALTHY COWS

Broadly speaking, healthy cows are the most important items of equipment on the dairy farm. They are the basis for the production of clean, wholesome milk. The cows not only must look healthy, but they also must be proved free from disease by examinations and tests performed by a competent veterinarian.

Tuberculosis in dairy cows, especially in the udder, may be a source of tuberculosis in human beings. Tuberculosis is infectious. It spreads in a herd from cow to cow. As the disease develops slowly, a cow may be affected with it for several months or even years before any marked physical changes in the animal are noted.

Most dairymen are familiar with the plans in effect for the control and eradication of bovine tuberculosis. Under these plans, the cattle are tested periodically, and any that react to the test are slaughtered. All counties in the 48 States are now in what is known as the modified accredited area, indicating that they are practically free of bovine tuberculosis. However, tuberculosis in livestock is still an important disease, as there is still residual infection. Every precaution should be taken in buying animals to see that they are from herds known to be free of tuberculosis.

Bovine brucellosis, also known as Bang's disease and infectious abortion, is an infectious disease of cattle that causes the loss of $100,000,000 a year to the cattle industries. Brucellosis in cattle is caused by a germ commonly known as *Brucella abortus*. This germ sometimes causes undulant fever in man, the disease being acquired either through consumption of raw milk from brucellosis-infected cows or through direct contact with infected cattle or their carcasses. The extent of the disease among people is not completely known.

To avoid danger of contracting undulant fever, the milk should come from herds that are free from brucellosis, and it should be pas-

teurized. The presence of brucellosis in cattle is detected by the blood agglutination test. An infected herd may be freed from brucellosis through the segregation and elimination of all reacting animals. Calves vaccinated between 4 and 8 months of age develop an increased resistance to brucellosis. The disease is spread largely through the introduction of animals of unknown health status into the herd. It is important, therefore, to purchase animals only from herds known to be free from brucellosis, to have them tested, and to keep them segregated until it is established definitely that they are disease-free.

A similar disease in swine is caused by a closely related species of organism known as *Brucella suis*. This species will also cause undulant fever in man if he comes in direct contact with infected swine or their carcasses. Where swine and cattle run together it is possible for the organism to be transmitted from one to the other.

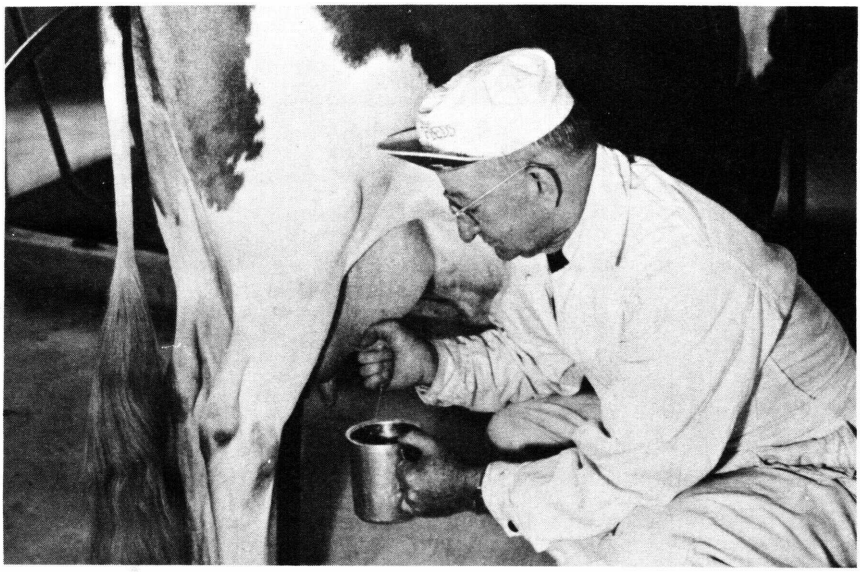

FIGURE 1.—Examining milk for abnormal appearance by using a strip cup.

Mastitis is an inflammation of the mammary gland. It may be caused by bacterial infection or by injury to the teat or udder tissue, and it may be aggravated by either or both. Mastitis not only may reduce milk production, but it may be caused by bacteria that are dangerous to the health of the people who drink the milk. Mild cases may not be evident from examination of the udder, so the milk should always be examined carefully for abnormal appearance. (See fig. 1.)

Milk that is slimy, ropy, watery, or abnormal in any respect, or that comes from an animal that appears to be sick or out of condition, should not be consumed by human beings.

It is also well not to use milk from cows that have been given powerful drugs, as the drugs may pass into the milk.

As a rule, for 15 days before a cow calves and for 5 days after she calves, her milk should not be used for human consumption.

To aid in keeping cows healthy and in keeping them clean with as little labor as possible, the barn should provide plenty of sunlight and ventilation and should be constructed with tight, smooth walls and ceilings and watertight floors and gutters.

Whenever possible the cow barn should be on high ground with good natural drainage; and poultry houses, privies, hog sheds, and manure piles, which pollute the barn air and furnish breeding places for flies, should not be close to it. A good location for a barnyard is on a south slope that drains away from the barn. If the barnyard tends to be muddy this may be remedied by drainage and by the use of cinders or gravel. A clean yard is a great help in keeping cows clean. Figure 2 shows the interior of a substantial, practical, and well-built dairy barn.

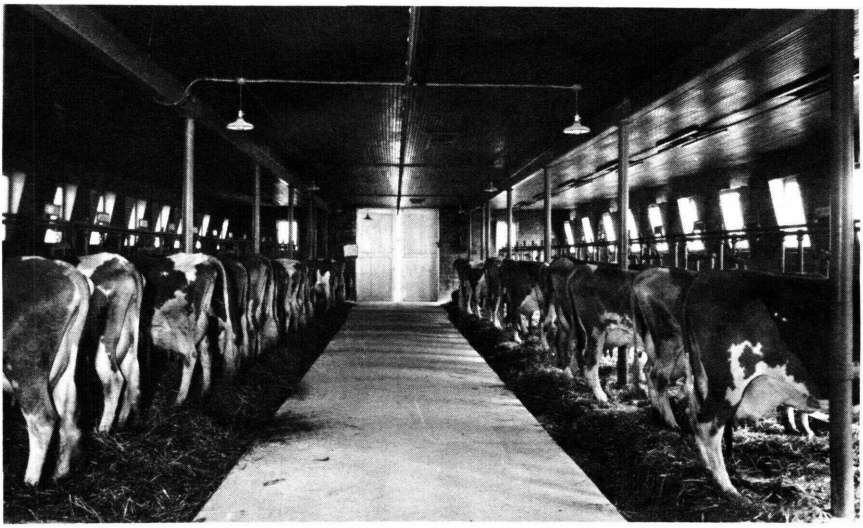

FIGURE 2.—Interior of a good dairy barn. Construction, equipment, lighting, ventilation, etc., of this kind make it easy to keep the floor, walls, ceiling, and fittings clean and sanitary.

The barn should have a hard, waterproof floor that can be cleaned easily. A concrete floor is easy to clean and prevents waste of liquid manure; such a floor tends to be cold, but extra bedding will remedy this condition. See that the gutter back of the cows is large enough to hold the droppings; a width of from 16 to 18 inches and a depth of 7 inches usually is sufficient. The gutter should slope so as to drain readily, unless the liquid manure is taken up by absorbents.

Types of stalls and mangers that have the least possible surface for collecting dust and dirt and offer the least obstruction to the circulation of air are the most satisfactory. Wooden stalls have many surfaces and cracks that are hard to keep clean, and in case of disease they cannot be disinfected as thoroughly as can stalls made of metal pipes. A swing stanchion is usually preferred, as it allows the cow plenty of freedom. A low, smooth manger without sharp angles is easy to keep clean. If the cows face the middle of the barn, the walk behind them

should be 5 feet or more in width so that the walls will not be soiled by the spattering from the gutter or the manure carrier.

Tight, smooth ceilings and smooth walls without ledges are easy to keep free from cobwebs, dust, and dirt. Unless walls and ceilings are painted, whitewash should be applied freely at least twice a year, as it helps to purify the barn and to keep it light.

A cow barn should be well-lighted; 4 square feet of glass per cow is sufficient if the windows are well-distributed and not obstructed in any way. If the barn is built with its length north and south, it gets the benefit of both the morning and afternoon sun.

The barn air should always be fresh and pure but should be free from drafts. If the odor in the barn is disagreeable at any time, it shows that the ventilation is poor. At least 500 cubic feet of air space should be provided for each cow.

Disease may be spread from farm to farm and milk may become infected if care is not taken in the disposal of wastes from human beings and domestic animals. Disease-producing bacteria may be carried from exposed excreta by flies, rats, birds, etc., or they may be washed into the water supply. Barn manure and outhouse deposits should be disposed of in such a way that there is no possibility of their being a source of contamination of the milk.

Provision should be made to haul barn manure directly to the field and to spread it at once. When this is not feasible, put it in a covered storage pit or bin at a safe distance from the barn and milk house. Such treatment of manure not only protects health but also saves valuable fertilizing materials. Figure 3 shows how manure is promptly removed from the barn on one good dairy farm.

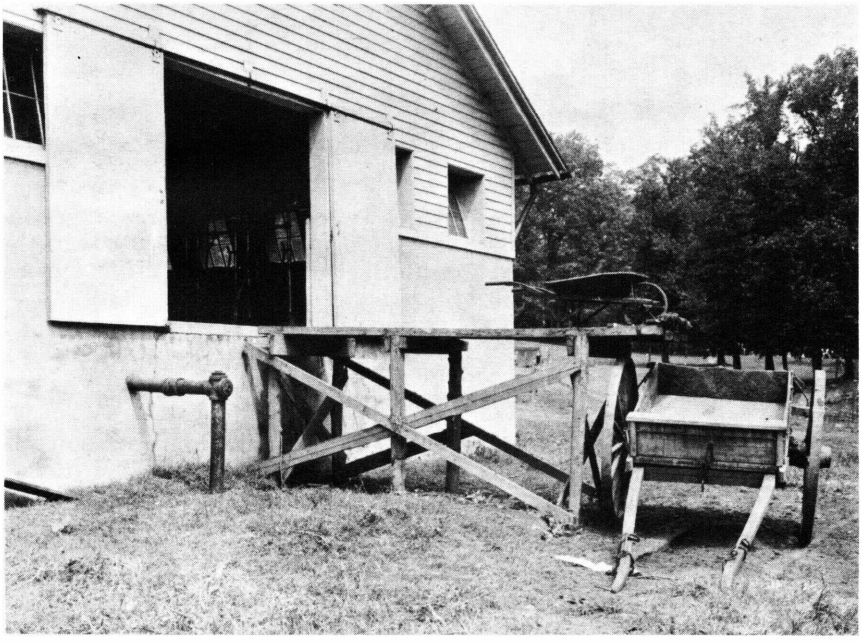

FIGURE 3.—A simple and efficient way to handle manure on a small dairy farm. The prompt removal of the manure from the barn directly to the field avoids loss of manure and also keeps the barnyard clean.

Do not feel discouraged, however, if you do not have an elaborate and expensive barn, as clean milk can be produced in a barn of simple and inexpensive construction by using careful methods. Figure 4 shows the interior of a dairy barn where clean milk is produced. It is an old, inexpensive type but has plenty of windows and tight floors which are easy to keep clean.

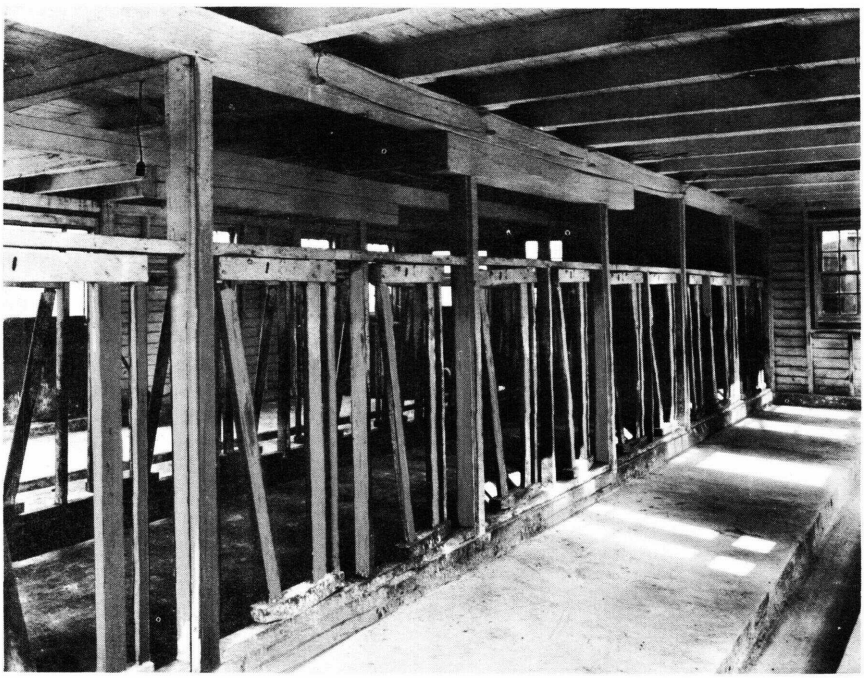

FIGURE 4.—Interior of an old, inexpensive dairy barn where clean milk is produced.

In recent years, the "loafing" or pen type of barn has received considerable attention. The cows run loose in these barns between the times when they are being fed and milked in a special milking barn. From the viewpoint of clean milk production, the main points to be observed in this system are to have enough clean bedding in the pens to keep the cows clean and to have a well ventilated, clean milking barn.

UTENSILS [2]

All milk utensils should be of simple construction, durable, smooth, and nonabsorbent. They must have no open seams where dirt can lodge and bacteria can grow. They should not be battered or dented, as this makes them hard to clean. Tinned utensils should be covered completely by the tin plating. If the basic material is of iron and is not completely covered by a tin coating, it will rust. Rusty utensils are difficult to clean, and the rusty iron harbors bacteria and may also impart off-flavors to the milk. If the basic material is copper or

[2] The term "utensil" as used in this bulletin refers to any appliance that comes in contact with milk or cream during production or handling, such as milk pails strainers, cans, separator parts, and milk bottles.

brass and is not completely covered by a tin coating, an oxidized flavor is likely to develop in the milk.

Strainers should be constructed so that they can be dismantled completely for thorough cleaning. The troughs of surface coolers should be removable so that they can be cleaned thoroughly after each use, and the cooling surface should be built so that there are no cracks or open seams with which the milk may come in contact.

Milk cans should be smooth, with no open seams, dents, or rust spots. The cover should fit the can snugly and should extend over its lip.

Much of the dirt that gets into milk falls from the cow into the pail at milking time. There are fewer bacteria and there is less sediment in the milk when the small-top pail is used than when the open-top pail is used. The small-top pail should be durable, should have smooth seams, should be easy to milk into, should be easy to clean, and should have only a small opening. A number of types of small-top pails are on the market. Any tinner can convert an ordinary open-top pail into a small-top pail at little cost, by putting on a hood as shown at the right in figure 5.

MILK ROOM OR MILK HOUSE

The building in which the milk is handled should be convenient to the barn, but located so as to be free from dust and barn odors. The ideal place for it is in a well-drained location somewhat higher than the barn. It should not be close to the barnyard, pigpen, privy, or other source of contamination. The milk house may be connected with the barn by a covered, well-ventilated passageway (fig. 6) with self-closing doors at each end to keep out barn odors. It may be in the same building as the barn, but if so it should have a separate outside entrance and the walls should be tight and without a directly communicating door or window.

It is advisable to divide the milk house into two rooms, one for handling the milk and the other for washing the utensils. (See figs. 7 and 8.) Plan the milk house and all of its equipment so as to save as much labor as possible, not only in handling the product but in keeping the building clean.

There should be no unnecessary ledges or rough surfaces inside the building. The floors should be of concrete and pitched to drain to bell traps. Where floors and walls meet, the joints should be coved to prevent the collection of dust and dirt. The walls and ceilings may be of matched boards, but smooth cement plaster on metal lath is better. Ventilators are necessary to keep the air in the milk room fresh and free from musty and undesirable odors and to carry off steam from the washroom. Windows are very important, as they let in fresh air and sunlight and make work easier. The sills should be narrow and slope sharply down from the window. In summer the doors and windows should be screened to keep out flies and other insects.

A plentiful supply of running hot and cold water in the milk house is necessary. The dairyman cannot afford to spend his time carrying water in a pail to cool the milk and wash the utensils.

For efficient operation, equipment in the milk-handling room should be of simple construction and should be easy to clean. Minimum equipment consists of a strainer, a surface cooler, and a cold storage tank or box. Additional equipment, such as separators, churns, etc.,

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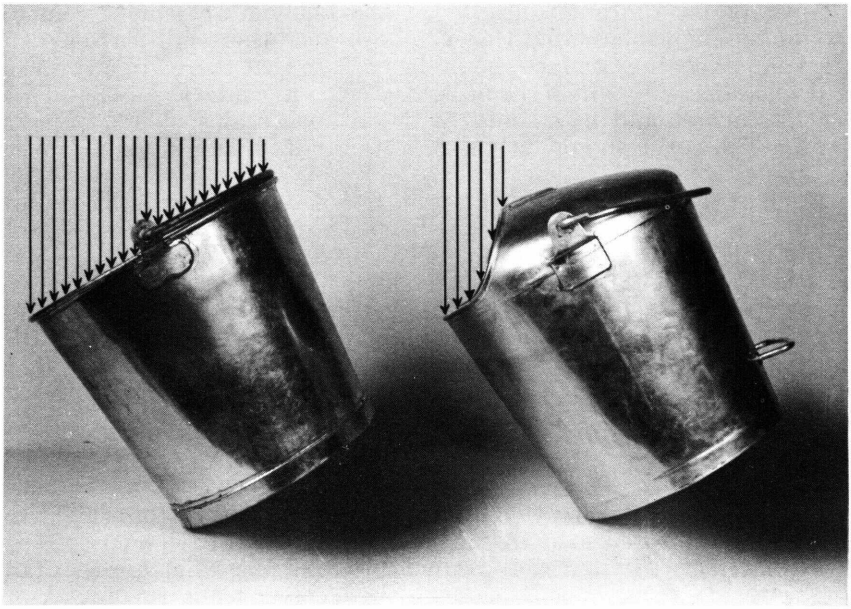

FIGURE 5.—Open-top and small-top milk pails.

FIGURE 6.—A dairy house consisting of two workrooms and a boiler room, and connected to the barn by a covered passageway.

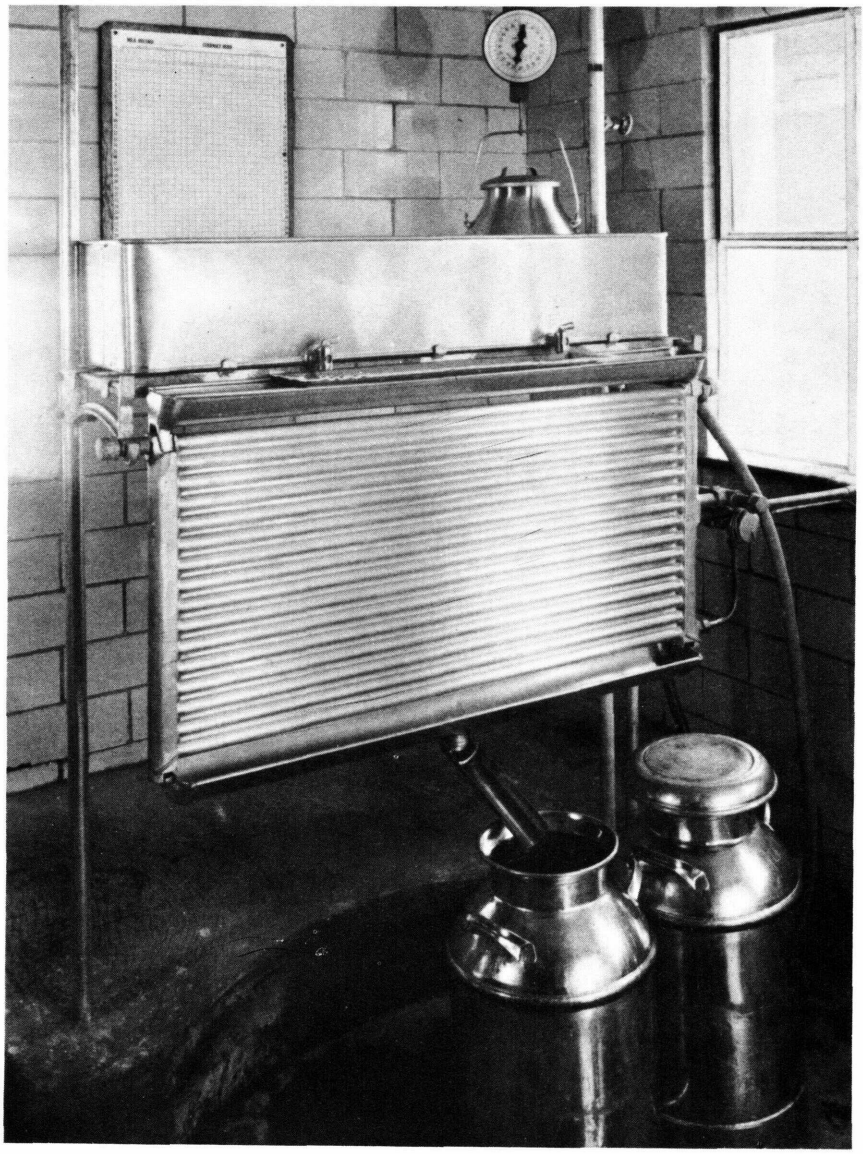

FIGURE 7.—A well-arranged milk handling room. A scale and weight chart are in the rear. Strainer is in upper trough of cooler.

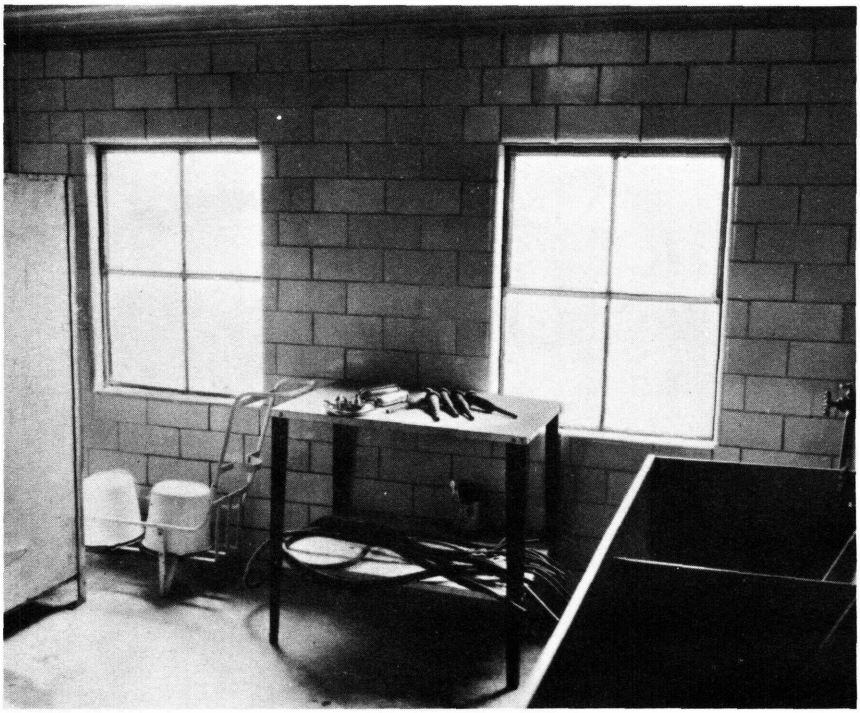

FIGURE 8.—A clean washroom with steam cabinet in the left rear.

will depend on the requirements of each farm. This room is also a good place for a washbasin with soap and towels, so that the milker can wash his hands before milking each cow. The washroom should contain a wash sink and a rinse sink with running hot and cold water, a drying rack for utensils, and preferably, a steam cabinet for treating the equipment to kill bacteria.

Before buying any equipment consult your local health officer to make sure that it will comply with the regulatory requirements for your market.

METHODS

Although proper equipment is important and helps greatly in the production of clean milk, the main consideration must be the methods used in production. Good equipment improperly handled is useless. It has been demonstrated both experimentally and in actual practice that the average dairyman on the average farm, without expensive barns and equipment, can produce milk (practically free from visible dirt) which when fresh has a low bacterial count. This result was obtained by observing three essential factors: (1) The use of sanitized utensils; (2) clean cows, particularly the udders and teats; and (3) the use of the small-top pail.

CLEAN COWS

The body of the cow, especially those parts of the belly, flanks, and udder that are immediately above the milk pail, may be a source of bacterial contamination, because manure, loose hairs, bedding, and

other foreign matter may fall into the pail. Samples of fresh manure have been found to contain nearly 50 million bacteria per gram. (There are 453.6 grams in a pound.)

Have the cows clean at milking time. Cows usually keep cleaner when they are on pasture than when they are kept in the barn, but although they look clean they may be very dusty and therefore need to be brushed. (See fig. 9.) When the cows are in barns, clean them thoroughly at least once a day. Clip the long hairs from their udders, flanks, and tails so that dirt will not cling to them. Before milking,

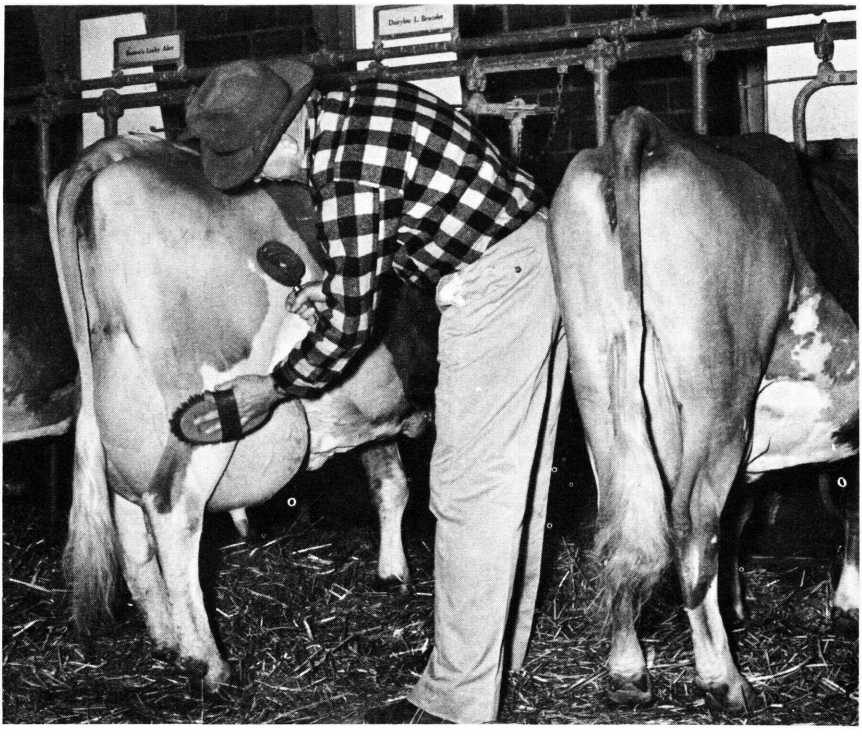

FIGURE 9.—Currying the cows in a modern dairy barn. The cows should be curried some time before they are milked.

carefully wipe the udders, flanks, and bellies with a clean, damp cloth (preferably dampened in a clean chemical solution) to remove dust and loose hairs. (See cover.) If these parts are very dirty, wash them. Plenty of bedding, good barns, and frequent removal of manure will help to keep the cows clean.

In an experiment by the Bureau of Dairy Industry (in which open-top milk pails that had been washed thoroughly and treated with steam were used) fresh milk from dirty cows had an average bacterial count of 55,208 per cubic centimeter, whereas fresh milk from clean cows with udders and teats washed averaged only 4,947 per cubic centimeter. (A cubic centimeter is about 16 drops.)

CLEAN BARNS

To produce clean milk, a clean, light, well-ventilated barn—although not essential—is a great help. A clean barn reduces the possibility of

contamination of milk and also has a good psychological effect on the milkers. In clean surroundings men are more inclined to keep themselves, the utensils, the cows—and thus the milk—clean.

The floors, walls, ceiling, mangers, stanchions, windows, and window ledges should be cleaned long enough before milking so that the air at milking time will be free from dust and odors. Dusty feed and feeds with strong odors should be fed after milking. Good ventilation will remove ordinary amounts of dust and odors but not excessive amounts. Excessive amounts of dust and odors in the air will lower the quality of the milk.

The bedding in the barn must be kept clean. Clean bedding not only helps to keep the cows clean but also helps to prevent direct contamination of the milk.

The barnyard should be well drained and clean. Mud and filth from the barnyard will soil the cows and will be tracked into the barn, causing extra work and providing a further source of contamination of the milk.

Manure should be removed from the barn at least once a day and when cows are kept in all day more frequent removal may be necessary.

CLEAN UTENSILS

Utensils that have not been washed properly and treated to kill bacteria contain large numbers of bacteria. Indeed, dirty utensils are usually the source of most bacteria found in market milk at the time of production and before bacterial growth has begun. Experiments have furnished convincing proof that milk is contaminated by utensils that have not been washed thoroughly and then subjected to heat or to treatment with a chlorine or other suitable chemical solution. The cleaning process, to be most effective, must start immediately after the utensils have been used.

An experiment conducted by the Bureau of Dairy Industry showed that by washing the utensils immediately after use the bacteria count of the milk was approximately 1 million per cubic centimeter less than when the utensils were washed 8 hours after use. Another experiment showed that milk drawn into steamed pails had an average of only 6,300 bacteria per cubic centimeter, whereas that drawn into unsteamed pails averaged 73,000.

Washing Utensils

Deposits on dairy equipment are in the form of a film, no matter how little the quantity may be. To treat this equipment with a germicidal solution before removing the film merely kills the bacteria on the surface of the film and allows those within the layer to flourish. Later, when this equipment is used in handling the milk, the surface of the film is washed off and the milk is exposed to the active bacteria growing beneath the surface. Furthermore, any organic material remaining on the equipment quickly dissipates the available chlorine in the germicide or, in smaller degree, the quaternary ammonium compounds.

Each piece of equipment should be rinsed thoroughly with cold or lukewarm water immediately after use. This greatly reduces the milk film remaining in the utensil and makes it easier to do an efficient job of cleaning. If the equipment is not rinsed immediately, the milk dries on the equipment, which makes thorough cleaning much more

difficult and time-consuming. Time spent rinsing the equipment saves time in the end.

Follow the rinsing as soon as practical with a thorough scrubbing. Use hot water, a good stiff brush, and a good dairy cleansing powder. Never use rags, soaps, or soap powders. Scrub all surfaces of each utensil with the brush and cleaning solution until they are absolutely

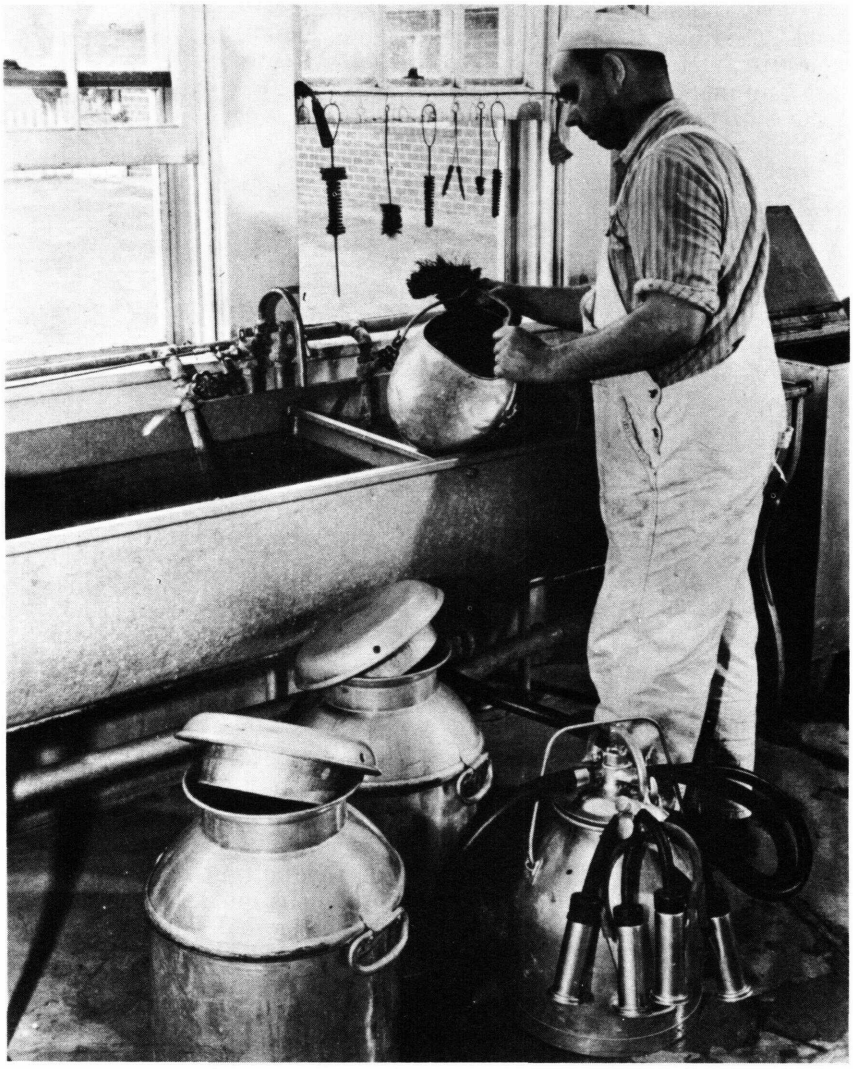

FIGURE 10.—Cleaning dairy equipment, with good light, hot and cold water, and steam available.

clean (fig. 10). Give special attention to all corners, seams, joints, and cracks, as these are the places where dirt naturally accumulates.

When the utensils are thoroughly clean, give them a good rinsing in clean hot water. Be sure to remove all traces of the cleaning solution.

After the utensils are completely clean, they are ready for the final treatment (which kills the bacteria on the utensils). This consists of treatment by steam or a suitable germicide, such as a chlorine or other chemical solution, or the utensils may be immersed in boiling water for 5 to 10 minutes.

Steaming Utensils

A steam boiler is the best source of heat for the heat treatment of utensils. It may be connected with a cabinet [3] built of concrete, brick, stone, tile, metal, or wood. Steam the utensils in the cabinet for at least 5 minutes at a temperature of at least 200° F. They may be left in the cabinet until they are used (fig. 11).

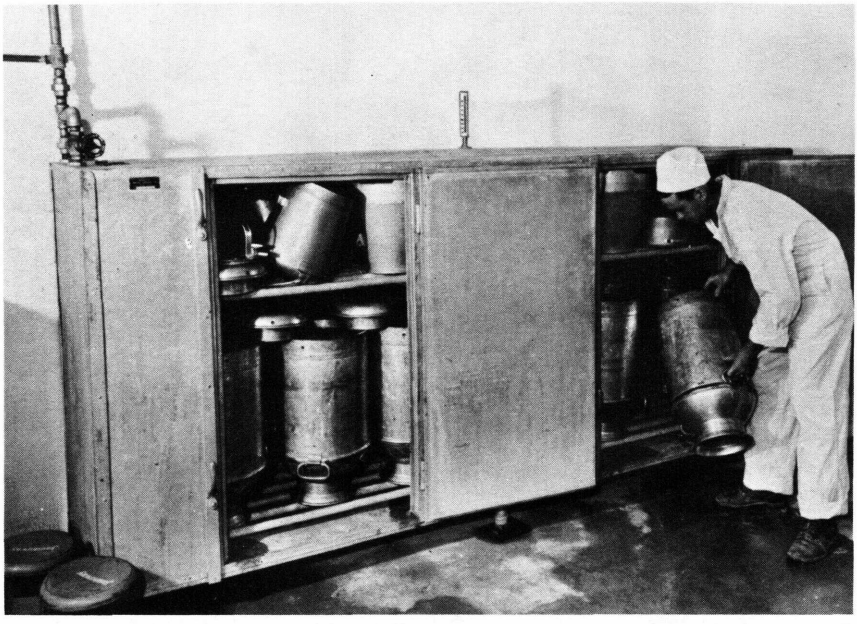

FIGURE 11.—A well-made steam cabinet, showing coils and thermometer.

Thorough drying of utensils after washing and steaming is extremely important. The steam coil in the bottom of the cabinet should give off enough heat to dry the utensils quickly. Never dry the utensils by wiping them with a towel or cloth; let them air dry, either by their own heat (retained after steaming) or by applying dry heat.

To be certain that the temperature is actually up to at least 200° F., the constant use of a thermometer is necessary. As some types of apparatus generate steam slowly, the length of exposure at 200° F. should be noted rather than the time the cabinet is in operation.

Chemical Treatment of Utensils

The chemicals that are commonly used for treating utensils to kill bacteria are sodium hypochlorite, calcium hypochlorite (also known as

[3] For further information on the construction and operation of a steam cabinet, see Farmers' Bulletin 1675, Care of Milk Utensils on the Farm.

chloride of lime), chloramine preparations, and quaternary ammonium compounds. These can be bought in packages of convenient size in a form ready to add to the rinse water—that is, in powder, tablet, or liquid form.

It is essential to wash and rinse the utensils thoroughly before putting them in the chemical solution. The active agent in these solutions is affected by organic matter, and if milk, cream, or dirt is present the strength of the solution is weakened before the active agent has a chance to attack the bacteria.

The effectiveness of the solution depends on its strength and the length of time the utensils are left in it.

A strength of 200 parts of the active agent per million parts of the solution is recommended. Be sure that the utensils are entirely covered with the solution and that they are immersed in the solution for at least 2 minutes. Eliminate all air pockets. The utensils do not need to be rinsed after using the chlorine solution. After using quaternary ammonium compounds, however, they must be thoroughly rinsed with clean, pure water. Turn the utensils upside down in a clean, dry place, free from dust and flies (preferably in the milk house), and do not touch them until they are needed.

Check with your local health authorities before using chemicals for treating dairy utensils.

The Milking Machine Must Be Sanitary

The parts of the milking machine that need the most attention are the rubber tubing, teat cups and inflations, claw, pail, head, valves, and moisture trap.

Immediately after milking, rinse the machine with cold or lukewarm water drawn through it by vacuum. The flow of water may be broken occasionally by pulling the teat cups out of the water. Do this 10 or 12 times. Repeat this operation, using hot water containing washing powder, and wash the teat cups and tubing with a brush. Then rinse the machine by drawing clean hot water through it by vacuum.

The heat method of treating the milking machine is simple and effective. Remove the long milk tube, with claw and teat cups, from the head of the pail. With a machine of the inflation type, plug the air tubes and put these parts in a tank or can. If steam is available, immerse all parts in clean water, and heat the water with steam to a temperature of 160° to 165° F. If steam is not available, heat the water on a stove, but do not put the rubber parts in the water while it is heating. Leave the parts in the water until the next milking, allowing them to cool slowly.

In treating the parts with chemicals, wash them as indicated above. Instead of putting the parts in hot water, however, put them in a chemical solution of the same strength as used for other utensils, and allow them to remain there until the next milking. If quaternary ammonium compounds are used, rinse the parts thoroughly with clean, pure water before using.

With any method the machine should be taken entirely apart at least twice a week and washed thoroughly with brushes and hot water containing washing powder.

The moisture trap, or check valve, on the head of the machine should be cleaned every day.

Milking-machine pails and covers should be washed thoroughly after every milking and then should be further treated with heat or a chemical solution to kill bacteria. If there are pulsators and electric motors on the head of the pail, they should be removed before the machine is cleaned.

The vacuum line should be cleaned at least twice a year, by drawing hot water containing washing powder through it with vacuum. The vacuum line should be cleaned immediately after milking if milk has been drawn into it.

MILKING AND HANDLING MILK

Healthy Milk Handlers

Some communicable diseases of man may be carried by milk. The bacteria causing these diseases drop into the milk, are introduced unknowingly by the milker, are carried by flies, or come from contaminated utensils. Many of these bacteria grow in milk, and they have caused milk-borne epidemics. Some of the diseases that may be carried by milk are tuberculosis, typhoid fever, diphtheria, scarlet fever, and septic sore throat. The bacteria that cause these and some other diseases can be carried by people who are apparently well or well enough to work. Great care must be taken to have only healthy people handle the milk or anything with which the milk may come in contact. No one should go from a sick room where an infectious disease exists to take part in any of the operations where milk is produced, handled, or kept.

Milkers Should Be Clean

Just before milking, each milker should wash his hands with soap and water and put on a pair of clean overalls and a jumper, or a suit which is used for no other purpose. Enough suits should be provided so that a clean one is always available. They should be washed regularly, and occasionally they should be steamed or boiled. Even the milking stool should be kept clean to avoid soiling the milker's hands.

Milk only with clean, dry hands, or with a milking machine that has been cleaned properly and treated to kill bacteria. Wetting the hands with milk is a filthy practice; it adds bacteria and sediment to the milk, and in winter it may cause the cow's teats to chap. Milk quickly and thoroughly, without jerking the teats.

Immediately after each cow is milked, take the pail of milk to the milk house. Never let it stand in the barn. The milker should always bear in mind that he is handling a human food which is contaminated very easily. Therefore, it is well for the milker to have soap, clean water, and towels accessible so that he can wash his hands before milking each cow.

Strain Milk Properly

After the milk is taken to the milk house, strain and cool it at once. Straining is best done through one of the commercial straining disks made to fit the strainer. Use these disks only once and then discard them. They are inexpensive and are sold by most dealers in dairy supplies. Keep a supply in a covered container near the strainer so that when a disk becomes dirty it can be replaced quickly with a clean one. Special strainer cloths for odd-shaped strainers are on the market. These also should be used only once and then discarded. If

the special strainer cloths or disks are not available, the next best choice is a layer of sterile absorbent cotton placed between two clean cloths that have been steamed or boiled.

Do not rely on straining to produce milk with a low bacteria count and good flavor. Straining does not remove bacteria nor does it, of itself, improve the flavor of milk; it merely removes the visible dirt from milk that has not been protected properly, and it protects the flavor of such milk by keeping the dirt from soaking in the milk until the soluble portions dissolve.

Because the visible dirt is partially soluble, it is imperative that the strainer disks be replaced frequently by clean ones. If this is not done, the milk that is later poured through the strainer washes the accumulated dirt and dissolves the soluble material, thus defeating much of the purpose of straining.

Cool the Milk Promptly and Keep It Cool

The presence of large numbers of bacteria in milk when it reaches the consumer is due to improper cooling and keeping the milk at too high a temperature during storage, transportation, and delivery. The rapidity with which bacteria multiply in milk at different temperatures is shown in table 1.

TABLE 1.—*Growth of bacteria in milk when the milk is held at 50° and at 68° F.*

Temperature of milk	Number of bacteria per cubic centimeter—				
	At beginning	At end of 6 hours	At end of 12 hours	At end of 24 hours	At end of 40 hours
50° F.	10	12	15	41	62
68° F.	10	17	242	61, 280	3, 574, 990

At the rates indicated, if the milk contained 1,000 bacteria per cubic centimeter when it was produced, the part held at 50° F. would have contained only 4,100 bacteria at the end of 24 hours, whereas that held at 68° would have contained 6,128,000. The effect of temperature on the growth of bacteria is shown graphically in figure 12.

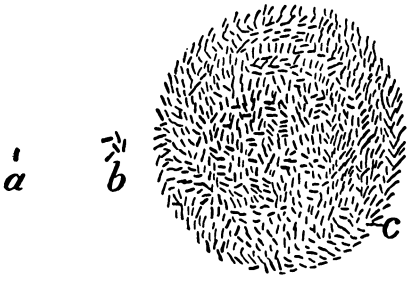

FIGURE 12.—This shows how rapidly bacteria multiply in milk that has not been cooled properly. In 24 hours a single bacterium (*a*) became five bacteria (*b*) in milk kept at 50° F. When the temperature of the milk was kept at 70° the single bacterium multiplied to the great number shown in (*c*) in the same length of time (24 hours).

A large part of the loss caused by the souring of milk is due to shipping the milk at too high a temperature.

Milk or cream must be cooled promptly to a temperature of 50° F. or below if rapid bacterial growth is to be prevented.

The use of a surface cooler (fig. 13) is especially necessary when the time between milking and shipping is short. If warm milk is run over a surface cooler supplied with the coldest available water and is then

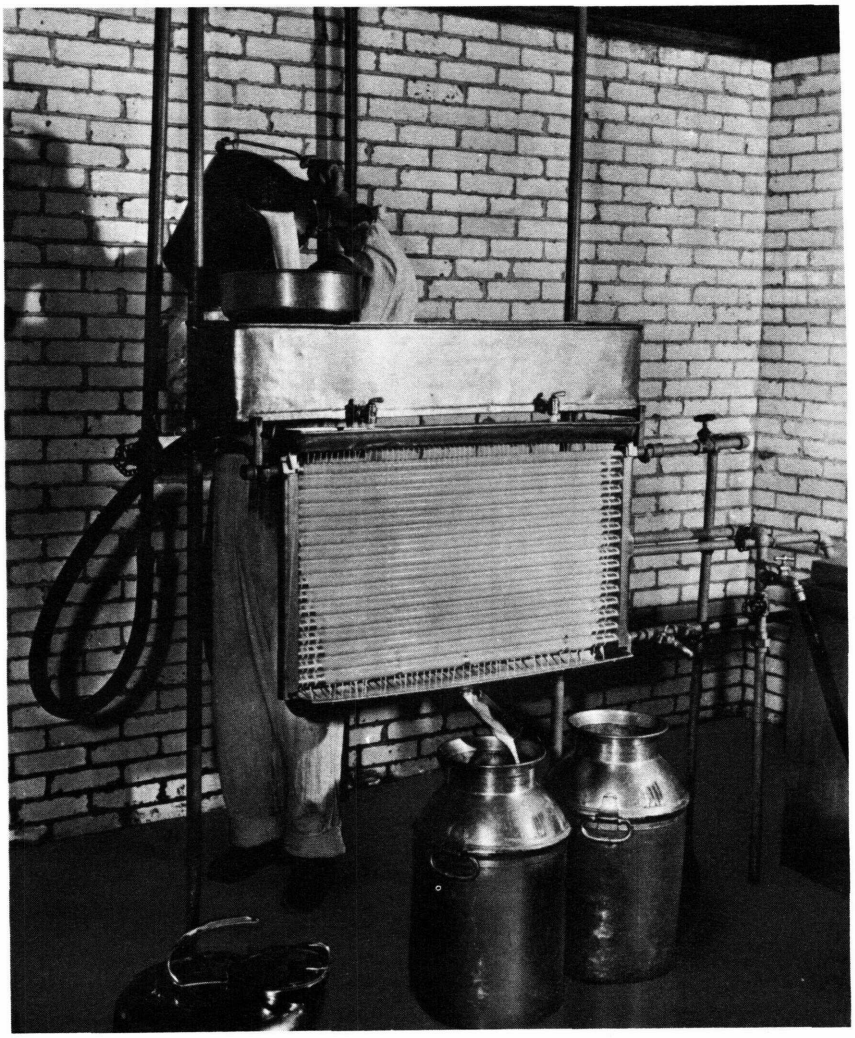

FIGURE 13.—Cooling milk with a surface cooler. Here the milk is strained as it enters the cooler supply tank. Cold water for the cooler is piped from the can storage tank at the right.

set in a tank of water cooled to 40° F. or below, it should not be difficult to cool the milk to 50° within an hour after it leaves the cow. A 10-gallon can of warm milk precooled with water at 55° and then set in a tank of water at 37° can usually be cooled to 50° in about 20 minutes. Many farmers fail to use a surface cooler to precool the milk; many farmers also fail to put ice in the cooling tank before putting the milk cans in the tank. Consequently, much milk reaches the shipping station in summer at too high a temperature.

With the increased availability of electricity, many farms now use mechanical refrigeration to cool the milk. Mechanical refrigeration can replace the use of ice by putting pipe coils in the storage tanks; and in surface coolers, either by using the refrigerant directly in the cooler or by first cooling water or brine which is then pumped through the cooler. (See fig. 14.)

FIGURE 14.—A mechanically refrigerated storage box for cans of milk.

Do not mix warm, fresh milk with cold milk, because the addition of warm milk to cold hastens bacterial growth by warming up the whole mass. Keep cans of milk covered to prevent the entrance of dust, dirt, insects, and other sources of contamination.

Cream sours more slowly than milk. Heavy, or rich, cream does not sour as quickly as thin cream; therefore, ordinarily, the cream should test from 30 to 35 percent of butterfat. Such cream makes less bulk to handle and leaves more skim milk on the farm than does thin cream.

Immediately after cream is separated, cool by the methods advised for milk. If only a small quantity is handled, put it into tall cylindrical cans, called "shotgun" cans, and place these in ice water. Do not mix fresh cream with previous skimmings until it has been cooled thoroughly.

CONTROL OF FLIES

Flies may carry millions of bacteria on their feet and bodies. They contaminate milk if they get on the utensils. They also mar the appearance of equipment, walls, ceilings, and windows, and they annoy the animals and caretakers. They are attracted by the cattle, piles of manure, spilled milk, and other feeding or breeding grounds. Flies breed in moist, decaying vegetable matter, especially manure.

Cleanliness and sanitation are the main requirements in the control of flies. Keep stalls clean, and clear away all feed around the mangers. Early in the spring remove straw that has been banked around the watering troughs and buildings. In warm weather haul away the droppings from the lanes and yards every week. Where manure is piled in the open, haul it away at least once a week, from early spring until winter. Flies breed very freely in calf manure, particularly if the calves are fed milk in any form. It is advisable to remove calf manure twice a week. Take away all the fine loose material under manure piles. This material is likely to be heavily infested, as the fly larvae work toward the outer edge and bottom of the piles.

Immediately after the manure is removed, treat the ground that was under the pile with a 28–32 gravity fuel distillate (fuel oil), at the rate of 5 gallons to 100 square feet. This will kill the larvae that have gone into the ground and may keep others from going into the ground for some time. This distillate need not be used more than once every 2 or 3 weeks. Do not apply it directly on the manure, because it contains substances that are injurious to plant growth.

Space Sprays

Space sprays are those that are sprayed with either hand or power equipment, so as to produce a fog which more or less fills the space being sprayed. These sprays usually are effective for a short time only. To be effective the spray must come in contact with the flies, or other insects, while it is still in liquid form. A light mist settling on the animals will usually repel flies for several hours after treatment. These sprays are usually made with an oil base and should not be applied to animals so that the hair and skin become wet with the spray.

Spray the places where the flies gather. Do this early in the morning, when the flies are somewhat sluggish, and late in the afternoon after they have fed and gathered for the night. Also spray their feeding places after large numbers have gathered on them. When flies are annoying to the cows it may be well to spray the animals. Do not force the spray directly into the hair. Apply the spray so that only a light mist will cling to the outer coat of the hair. Not more than 1 ounce should be applied to an animal. Do not brush the cows for some time afterwards. Horn flies must be sprayed while on the cattle, as they stay in no other place long enough to be hit with the spray.

Use a sprayer of good size, capable of standing a pressure of from 35 to 40 pounds, with a nozzle that will throw a heavy, fully atomized spray over a considerable area. An 8-foot extension will allow the operator to reach the ceilings and out-of-the-way places. If the manure is hauled away promptly, thorough spraying need be done only three times a week.

Residual Sprays

Residual sprays are those that are sprayed or painted on surfaces. Insects are killed by contact with the liquid spray or with the dried residue of the spray. The toxic effect of these sprays lasts from several days to as long as a month.

Good practice requires the spraying of all buildings and livestock on the farm. However, some insecticides (including DDT, benzene hexachloride, toxaphene, and chlordane) are not recommended for use on dairy cattle, or in dairy barns, milk rooms, rooms containing dairy feed, or in similar places on the farm. Methoxychlor, lindane, malathion, and Diazinon are recommended as residual treatments in dairy barns and other places where flies concentrate, except in milk rooms or feed rooms. Pyrethrum sprays are recommended as residual treatments on dairy animals.

For up-to-date and detailed information on sprays, write to the Agricultural Research Service, United States Department of Agriculture, Washington 25, D. C.

The Department of Agriculture recommends that the following precautions be observed in using sprays:

Always exercise proper care in storing, handling, mixing, and applying insecticides.

Store insecticides where neither children nor pets and other animals can get to them. Store those containing kerosene or xylene so that there will be no fire hazard, and do not mix or spray them in the presence of open flame or sparks.

Persons handling, mixing, or applying insecticides should take precautions to protect themselves against unnecessary exposure to skin contact or breathing of spray mist. Operators who apply sprays continuously and repeatedly should wear respirators and clothing that protects the body. Clothing should be changed frequently and if it becomes saturated with spray it should be laundered before it is worn again. Bathe or wash parts of the body with which insecticides have come in contact.

Apply insecticides in a manner to avoid accidental contamination of food and water for humans and animals.

Observe carefully the suggested concentrations and rate of application. Mix the materials thoroughly and agitate them continuously in the spray tank. If emulsion concentrates will not mix readily with water, and oily films accumulate, do not use the material.

Dispose of unused sprays in such a way as to avoid hazards.

IN SPRAYING DAIRY BARNS, TAKE SPECIAL PRECAUTIONS TO AVOID CONTAMINATING MILK OR UTENSILS. COVER WATER CUPS AND FEED TROUGHS, AND COVER OR REMOVE FEED WHILE SPRAYING.

KEEP FEED AND WEED FLAVORS OUT OF THE MILK

Milk is often made unsalable by feed and weed flavors. Feed flavors in milk are most frequently caused by succulent feeds. When fed to dairy cows 1 hour before milking, silage (made from corn, alfalfa, sweetclover, or soybeans), green alfalfa, cabbage, turnips, rape, and kale seriously affect the flavor and odor of milk. Green rye, green cowpeas, potatoes, dried beet pulp, and carrots affect the flavor and

odor of milk only slightly, and green corn, green oats and peas, green soybeans, pumpkins, and sugar beets have practically no effect on the flavor and odor.

Feeds affect the flavor of milk only a few hours after they are eaten. For this reason, feed dairy cows highly flavored feeds immediately after milking and not just before. Aeration of milk by running it over a surface cooler immediately after milking reduces strong feed flavors and sometimes eliminates slight ones.

Eradicate from pastures all weeds that cause objectionable flavors in milk. Until this is done, take the cows off infested pastures as long as possible before milking. The longer the interval between the removal of the cows from pasture and the time of milking, the less intense will be the undesirable flavors in the milk. In the case of garlic-infested pastures, the cows should be taken off the pasture 4 to 7 hours before milking to entirely avoid the garlic flavor and odor in milk. Some weeds, such as bitterweed, impart objectionable flavors to the milk as long as 24 hours after they are eaten. If such weeds are present, it may be necessary to keep the cows off the pasture until the weeds are eradicated.

SUMMARY

Milk is a food; treat it as such.

Milk is a highly perishable food, so it requires more than usual care in its handling.

Healthy cows are primary essentials for clean milk production.

Healthy milkers and milk handlers do not have disease germs to contaminate pure milk.

Clean cows with clean udders and teats are essential for the production of clean milk.

Clean milkers with clean, dry hands must milk into clean, sanitized small-top pails or use sanitized milking machines.

Clean, well-ventilated barns and milk-handling rooms are aids in the production of clean milk.

Milk utensils should be well constructed for easy cleaning.

All equipment with which milk comes in contact must be washed thoroughly and then treated to kill bacteria.

After producing clean, high-quality milk, take care of it by cooling it promptly and keeping it cool and covered.

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